EVALUATION OF THE REMOVAL OF A MINIMUM SIZE LIMIT ON WALLEYE IN GLENVILLE RESERVOIR, NORTH CAROLINA

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Abstract: The removal of a 381 mm minimum size limit on walleye in Glenville Reservoir, North Carolina did not significantly affect the mean calculated total length of those fishes at the first 3 annuli. However, a significant increase in calculated total length was determined at the fourth annulus. There were no significant changes in the mean calculated growth increments. Comparisons of net survey data collected before and after removal of the minimum size limit showed no change in the average catch of walleye per net-day. Also, there was no significant change in the mean total length and the mean age of walleye caught by anglers. The increased exploitation afforded by removal of the minimum size limit had no effect on the annual harvest of walleye and had a positive effect on the growth of older walleye.

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Fishery management in the mountain reservoirs of North Carolina historically has consisted of harvest regulations and introductions of exotic and forage fish species. Following impoundment of these reservoirs, the fish community was composed of lotic species which were able to successfully adapt and compete in the newly imposed lentic environment. Centrarchids, cyprinids and catostomids dominated the littoral zone with trout sometimes present in the hypolimnetic zone (Messer 1961). Fish production and total harvest was and still is low in these reservoirs due to their oligotrophic nature and fluctuating water levels. The sport fishery has been concentrated in the limited litoral zone while the major areas of the lake, the limnetic and profundal zones, have not been fully utilized due to the scarcity of pelagic and deep water game fish. Beginning in 1949, the North Carolina Wildlife Resources Commission attempted to establish reproducing populations of North American pelagic and deep water game fish in these reservoirs.

Walleye (*Stizostedion vitreum vitreum*) were introduced into Glenville Reservoir in 1954 and had become established by 1965 (Messer 1966). At the time of introduction, a minimum size limit of 381 mm total length (TL) was imposed on the walleye fishery. By 1965, the population of forage fish had been drastically reduced (123 kg/ha to 23 kg/ha) and the walleye population appeared stunted (Messer 1966). At the end of the third year of growth, walleye in Glenville Reservoir averaged 341 mm TL (SE = 2.6, N = 154), while those in Santeetlah and Fontana Reservoirs (nearby mountain reservoirs) averaged 391 mm TL (SE = 5.5, N = 17) and 399 mm TL (SE = 5.7, N = 32), respectively (District file records unpublished data).

The slow growth rate and reduced numbers of forage fish indicated that walleye should be able to withstand an increased harvest. The minimum size limit on walleye was removed in 1975 in an attempt to increase angler exploitation and to reduce the size of the population. This study was designed to evaluate the effects of removing the minimum size limit on walleye in Glenville Reservoir.

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METHODS AND MATERIALS

Glenville Reservoir was constructed in 1941 on the West Fork of the Tuckaseigee River by the Aluminum Company of America. It is operated under the Tennessee Valley

Authority system to provide downstream navigation and electrical power. This reservoir is one of the highest in eastern United States with a conservation pool elevation of 1,065 m (TVA 1954). At conservation pool level, it has a surface area of 591 ha, a mean annual water level fluctuation of 9 m and maximum and mean water depths of 41 m and 15 m, respectively (Jenkins 1967).

Walleye were collected with gill nets (37 m long by 1.8 m deep with a 3.8 cm bar mesh), trammel nets (20 m long by 1.8 m deep with a 3.8 cm and 215.2 cm bar mesh) and by anglers. The population was sampled by netting 1972, 1974, 1976, 1977 and 1978. Nets were set at various locations and were checked during each 24 h period. Catch-per-net-day was recorded while TL and scale samples were collected from each fish. Angler creels were checked periodically after sunset during May and June 1976 to 1978.

Walleye were aged according to the methods described by Tesch (1971). Back-calculations were accomplished using a regression equation derived by the method of least squares (Snedecor and Cochran 1967). Calculated TL at the first and second annulus were validated using the Peterson method described by Tesch (1971). Growth rate increments and calculated TL at each annulus of walleye populations under the 381 mm size limit regulation and under no size limit were compared by analysis of variance and a 0.05 level of significance (Snedecor and Cochran 1967). The age composition and mean TL of walleye captured by anglers in 1976 through 1978 were compared using analysis of variance and a 0.05 level of significance (Snedecor and Cochran 1967).

RESULTS

The mean calculated TL of 247 walleye captured (all methods) in Glenville Reservoir from 1972 through 1978 are presented in Table 1. Following removal of the minimum size limit, the mean calculated TL was not significantly different at the first three annuli but was significantly greater (0.05 confidence level) at the fourth annulus. Mean calculated growth increments before and after size limit removal showed no significant change between any two successive years.

No significant changes in mean age and mean TL of angler caught walleye occurred following removal of the minimum size limit. The mean ages and TL of angler caught walleye for 1976 through 1978 were 2.51-312 mm; 2.45-307 mm; and 2.46-301 mm, respectively.

Comparisons of netting data collected in 1972 and 1978 showed a mean of six walleye caught per net-day each year. Spot creel checks in 1972, 1976 and 1978 showed no change in catch rates.

During the period 1976 to 1978, walleye were recruited into the fishery during their second growing season (age 1+), at a mean TL of 207 mm. Angler catch was dominated by two and three year old fish (65%), while fish four years and older contributed only 17% of the harvest. No fish over six years old were found in any of the checked creels.

DISCUSSION

Fisheries can be categorized into 3 levels of exploitation: lightly fished, where fishing has no detectable effect on the population; moderately fished, where fishing has an effect but has not exceeded the maximum sustained yield (MSY); and overfished, where MSY is exceeded (Gulland 1971). Fishing regulations can be effective only in the latter 2 categories.

Historically, instead of improving the fishery, regulations often have been the cause of problems (Gulland 1971). Serns (1978) reported a decline in yield and catch of walleye 381 mm TL and greater, following enactment of a minimum size limit of 381 mm TL. Size limit regulations often fail to achieve their desired goal(s) because they are improperly designed or there is insufficient forage available in relation to the predator population.

TABLE 1. Calculated means at each annulus and mean increments between annuli on walleye collected in Glenville Reservoir, North Carolina by netting and angling before and after removal of a minimum size limit.

Year class	Number of fish	Mean calculated total length (mm) at each annulus										
		1		2		3		4		5		6
1968	1	150	87	237	63	300	24	324	13	337	6	343
1969	19	199	83	282	47	329	25	354	11	365		
1970	29	202	88	290	38	328	21	349				
1971	24	213	90	302	45	343	11	354	19	373	42	415
1972	16	213	93	306	42	348	24	372	26	398		
1973	20	221	91	312	35	347	1	348	29	377		
1974	51	204	93	297	50	347	26	373				
1975	80	201	87	288	60	348						
1976	3	201	104	305								
1977	4	215										
Number of fish		247		228		154		97		30		2
Mean total length[a]												
all		205		294		341		359		370		379
before		207		297		335		351		363		343
after		202		292		347		369		381		415
Mean annual increment*												
all		205		89		44		23		15		24
before		207		89		42		24		11		6
after		202		90		48		22		23		42

[a]Means calculated from above means and the numbers of fish comprising the mean.

Schneider (1978) found with model simulation that fish growth and exploitation rates determined the effect of minimum size regulations on catch statistics and population parameters of walleye in Michigan.

During 1950's when walleye were introduced into mountain reservoirs, it was felt that a minimum size limit was necessary to protect the population from overexploitation. Many states had a size limit of 381 mm TL and this was adopted by North Carolina. Once walleye populations had become established, minimum size limits stil[l] were retained. It was assumed that walleye needed continued protection and that this size limit would increase the number of large fish (381 mm TL and greater) in the lakes. This assumption has not proven valid on Glenville Reservoir.

The increased calculated TL at the fourth annulus was not reflected in the previous growth increments. If the growth rate increased after the size limit was removed, the increase may have been too subtle to affect the mean annual growth increments. Also, all of these fish grew through the first several years under a minimum size limit regulation which could have had an effect on growth rates. Through a cumulative effect an increased growth may have been able to produce the significant increase in total length by the fourth annulus even though this was not evident at the fifth annulus. A larger sample at the fifth annulus may have shown a significant increase in TL as found at the fourth annulus.

The use of different sampling methods each year of the study could have biased growth rate estimates. In addition, walleye are known to exhibit sexual dimorphism in growth rates (Ney 1978). However, the sex of walleye collected by fishermen were not recorded because individuals objected to dissection of creeled specimens. In addition, too few net-caught walleye were sexed to draw any conclusions. If the samples collected prior to 1975 contained a greater percentage of males than the samples collected after 1975, the data would reflect the sexual differences in growth and not the growth rate of the entire population. It is assumed that the same proportion of both sexes were sampled before and after removal of the minimum size limit. It is concluded, therefore, that removal of the mimimum size limit regulation on walleye in Glenville Reservoir has had little effect on the walleye population.

Declines in CPUE, mean age and mean TL are indications that overfishing is affecting a population (Gulland 1971). Analysis of gill net and angler catch data shows no change in these parameters since the minimum size limit was removed. The lack of significant changes in these parameters is a strong indication that the exploitation rate of walleye in Glenville Reservoir is low and the population is underharvested.

Glenville Reservoir experiences the most fishing effort for walleye per hectare of any reservoir in North Carolina and it is also the smallest reservoir in the State with a reproducing walleye population. Therefore, if removal of the minimum size limit was detrimental to the walleye fishery in North Carolina high mountain reservoirs, it should be most apparent in Glenville. The lack of an appreciable change in the walleye population in this reservoir, following removal of the minimum size limit, indicates that fishing pressure in larger, less intensively exploited high mountain reservoirs would be insufficient to cause overexploitation of the walleye fishery.

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